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Performance of okra under litchi based agroforestry system

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Abstract: A field experiment was conducted at the Agroforestry Farm, Hajee Mohammad Danesh Science and Technology University, Dinajpur, during 08 January 2009 to 08 April 2009 to evaluate the performance of Okra plant under litchi based agroforestry system. The treatments were three okra variety viz. hybrid okra variety, BARI-1 and local okra variety, which were used as ground layer crop. There was also control (sole cropping) treatment. This experiment was laid out using two factors Randomized Complete Block Design (RCBD) with three replication. The aim of the experiments was to study the growth performance and selection of potential okra variety under litchi based agroforestry system. The yield contributing parameters were maximum in sole cropping of hybrid okra. The yield was highest (10.24 t ha^{-1}) in monocropping of hybrid okra and the lowest yield (4.24 t ha^{-1}) was found in T_6 (Litchi + Local okra variety). But the litchi based agroforestry system ensures higher return and more sustainable than sole cropping. The suitability of okra variety may be ranked as Okra hybrid variety > BARI-1 okra > Local okra variety.
Key words: Okra variety, Litchi tree, Agroforestry system.

Introduction

Diversification of present cropping pattern coupled with development of suitable technology packages seems to be the need of the day to cope with the ever increasing demand for diversified products and assured income. In developing countries like Bangladesh due to huge increase in population, land resources are shrinking and it is very difficult to bring arable land under forest cover. Increasing demand for food, fodder and timber can be met through agroforestry. Agroforestry has long during been considered as a panacea for maladies of intensive. It is a way out to practice agriculture without deteriorating agro-ecosystem services while maintaining or improving productivity, stability or in other words sustainability. Okra (*Abelmoschus esculentus* L.Moench.) is an important vegetable crop of family malvaceae, which is originated in Africa or Asia has been growing in Bangladesh as an important vegetable crop predominantly in the summer season. Okra is grown year round in Bangladesh. However, due to some environmental limitations only a few varieties are grown during the rainy season. The bulk of its production is obtained during the winter season. The litchi (*Litchi chinensis*) is a delicious, juicy fruit of excellent quality. It is a very popular fruit in our country. It is an evergreen tree and a perfect multipurpose tree. It grows well all over Bangladesh especially in the northern part of the country. Total production of litchi is 43767 m. ton and total production area under garden is 5789 acre, average yield per fruit bearing tree is 49 kg (BBS, 2007). On the other hand, the minimum dietary requirement of fruit per day per capita is 85 g, whereas the availability is only 30-35 g. Though fruits are important source of vitamin and minerals, the availability and consumption of fruits in Bangladesh are much less than it should be. As a result, fruits are very costly in the country and majority of people can't afford to buy them and is being suffering from malnutrition. Therefore, production of okra in association with litchi tree may be an ideal combination of two high value crops. Scientific research is needed for investigating interaction effects of Litchi-Okra production system.

Materials and Methods

The experiments were conducted in Agroforestry Research Farm, Hajee Mohammad Danesh Science and Technology University, Dinajpur during 08 January 2009 to 08 April 2009. The site was between 25º 13´ latitude and 88º 23´ longitude, and about 37.5 m above the sea level. The experimental plot was situated in a medium high land belonging to the old Himalayan Piedmont Plain area (AEZ 01). Land was well-drained and drainage system was well developed. The soil texture was sandy loam in nature. The soil pH was 5.1. The aim of the experiment was to evaluate the performance of Okra plant under litchi based agroforestry system. The treatments include three okra variety viz. hybrid okra variety, BARI-1 and local okra variety, which were used as ground layer crop. There was also control (sole cropping) treatment. This experiment was laid out in the two factors Randomized Complete Block Design (RCBD) with three replications. The hybrid okra variety having brand name US Agriseed Tm. This seeds were marked by Seed Works India Pvt. Ltd. On the other hand, BARI-1 was collected from Bangladesh Agriculture Research Institute, Gazipur and the local okra variety was collected from local seed market of Dinajpur. The age of the litchi trees were five years with spacing of 5m × 5m. Each plot size was 2.5m × 2.5m. Adjacent plots and neighboring blocks were separated by 0.5m × 3m, respectively. The land was prepared thoroughly by spading to obtain a good tilth. All weeds and stubbles were removed from the filed and bigger clods were broken into smaller pieces. Recommended doses of fertilizers were used for the respective Okra variety and intercultural operations were done as and when necessary to keep the crop weed free and to pulverize the soil. Heavy irrigation was given three times at 15, 30 and 50 DAS, respectively. Data were statistically analyzed using the (ANOVA) "Analysis of Variance" technique with the help of the computer package MSTAT. The mean differences were adjusted by the Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Growth Parameters of okra as influenced by litchi tree: Plant height at different Days After Sowing (DAS) was significantly influenced by over storey Litchi tree (Table 1). Significantly, the tallest plant at 30, 60 and 90 DAS were recorded 28.90, 84.30 and 127.8 cm, respectively in (T_1) sole cropping of Okra hybrid variety followed by T_5 (28.30, 79.10 and 112.8 cm), at 30, 60 and 90 DAS respectively. Significantly, the shortest plants at 30, 60 and 90 DAS were 15.68, 26.78, and 43.56 cm respectively in sole cropping of local okra variety (T_3). The increase in plant height with corresponding increase

of plant population was due to the less light penetration through the canopy which was also reported by Fawusi (1985). The sole crop has received more light than the intercropped treatment and eventually the plant remained shorter than that of intercropped treatment. Similarly higher plant height under reduced light levels was also observed in eggplant (Miah, 2001) and (Ali, 1998; Islam, 1996) and in chickpea (Murshed, 1996). This may be attributed due to the simulation of cellular expansion and cell division under shaded condition (Schoch, 1972). On the other hand, leaf plant^{-1} (number) was significantly influenced by over storey tree (Litchi) canopy. At 30, 60 and 90 DAS, highest number of leaf plant^{-1} (8.80 13.40 and 15.20, respectively) were recorded in T_1 (Table 1). Significantly, the lowest numbers of leaf plant-1 at 30, 60 and 90 DAS observed were 5.40, 7.10 and 8.40, respectively in T_6 (Litchi + Local okra variety). Number of leaves was greater in sole crops because of vigorous growth and plenty of food materials production & uptake. Increased plant density (multistoried) was found to reduce leaf number & thereby leaf area per plant. (Muoneke and Udeogalanya, 1991). Similar result was also found by Wadud (1999) in case of okra. In case of leaf size maximum was recorded at 30, 60 and 90 DAS was 977.7 cm^2, 1033 cm^2 and 1313.0 cm^2 in sole cropping of Okra hybrid variety (T_1) followed by 599.5 in T_4 (Litchi + Okra hybrid variety). Significantly, the minimum leaf size at 30, 60 and 90 DAS observed were 514.4 cm^2, 595.6 cm^2 and 670.5 cm^2 respectively in sole cropping of local okra variety (T3).

Table 1. Plant height and number of leaf of okra at different DAS as influenced by litchi based agroforestry system

Treatment	Plant height (cm) at			Leaf Plant^{-1} (number) at		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T1	27.10ab	63.40c	72.40de	8.80a	13.40a	15.20a
T2	25.20b	48.30d	66.20e	8.65a	10.0ab	12.20bc
T3	15.68c	26.78e	43.56f	8.0b	8.40bc	10.40bcd
T4	28.90a	84.30a	127.8a	6.75c	10.0ab	13.0b
T5	28.30a	79.10b	112.8b	6.60c	7.195bc	9.50cd
T6	27.60ab	51.40d	88.46c	5.40d	7.10bc	8.40d
Level of Sig.	**	**	**	**	**	**

** 1% level of significance * 5% level of significance

Table 2. Growth and Yield contributing characters of okra as influenced by litchi based agroforestry system

Treatment	Leaf size (cm^2) at			Fruits plant^{-1}	Fruit Length (cm)	Fruit Girth (cm)
	30 DAS	60 DAS	90 DAS			
T1	977.7a	1033.0a	1313.0a	8.50a	14.25a	7.43a
T2	427.2bc	613.9d	743.6b	7.25b	12.25bc	6.70b
T3	514.4bc	595.6f	670.5e	6.45c	12.75b	7.33a
T4	599.5b	877.3b	1042.0b	7.34b	13.75a	7.36a
T5	521.5bc	730.9c	961.8c	5.53d	11.90c	6.45bc
T6	411.5bc	604.8e	692.9d	4.25e	11.75c	6.37bc
Level of Sig.	**	**	**	**	**	**

** 1% level of significance * 5% level of significance MAP= Month after Planting

Table 3. Yield contributing parameters and Yield of okra as influenced by litchi based agroforestry system

Treatment	Fruit weight (g) plant^{-1}	Single fruit weight (g)	Dry weight of fruits (g)	Yield (t ha^{-1})
T1	159.72a	18.79a	10.25a	10.24a
T2	119.90b	16.13b	9.15b	7.68b
T3	104.01c	16.13b	9.15b	5.28d
T4	119.90b	16.33b	9.65c	6.65c
T5	104.01c	16.33b	9.65c	5.12e
T6	66.29d	15.61b	8.95c	4.240f
Level of Sig.	**	**	**	**

** 1% level of significance * 5% level of significance MAP= Month after Planting

Yield Contributing Parameters of Okra as Influenced by Litchi Tree: Number of fruits plant-1 was also influenced by the over storey multipurpose tree species (Table 2). Significantly, the highest number of fruit plant^{-1} (8.50) was recorded in T_1 (sole cropping of hybrid okra variety) and the lowest number of fruit per plant^{-1} (4.25) was observed in T_6 (Litchi + Local okra variety). Lower number of fruits per plant under relatively more and

prolonged shaded conditions was probably due to poor photosynthetic capacity of plants. The decreasing photosynthetic capacity of shaded plants was attributed due to both stomata and mesophyll cell properties (Wolff, 1990). The present results are in support of Rahman (2006) who found the highest number of fruits per plant in open field when eggplant grown as multistoried system. Consequently, the highest fruit length (14.25 cm) was recorded in sole cropping of okra (T_1) which was statistically similar with T_4 (13.75 cm) and the lowest fruit length (11.75 cm) was observed in T_6 (Litchi + Local okra variety). Similar result was also reported by Rahman (2006) on performance of cane and eggplant in multistoried agroforestry system. On the other hand, the highest fruit girth (7.43 cm) was recorded in T_1 which was statistically similar with T_4 (7.365 cm) and T_3 (7.335 cm) and the lowest fruit length (6.37 cm) was observed in T_6 (Table 2). The lower fruit girth under heavy shade may be associated with the lower mobilization of reserve assimilation to reproductive organ. Similar finding incase of okra and eggplant was also reported by Wadud (1999) and Rahman (2006), respectively. Apparently, fruit weight plant^{-1}, single fruit weight and dry weight were maximum (159.72 g, 18.79 g and 10.25 g) in sole cropping of okra hybrid variety while minimum (66.29 g, 15.61 g and 8.95 g) fruit weight plant^{-1}, single fruit weight and dry weight were recorded in Litchi + Local okra variety. Reduced dry matter of plants and fruits was also reported by Fawusi (1985).

Yield of Okra as Influenced by Litchi Tree: Fruit yield (t ha^{-1}) of okra significantly varied under Litchi based agroforsetry system. Significantly, the highest yield (10.24 t ha^{-1}) was found in sole cropping of okra hybrid variety that was followed by (7.685 t ha^{-1}) in T_2 (sole cropping of BARI-1 variety). The lowest yield (4.24 t ha^{-1}) was found in T_6 (Litchi + Local okra variety). The present results are in support of the findings of Sivan (1984) where 40% yield reduction was noticed when okra was intercropped with taro. However, the less light was not as deleterious in case of okra as was experimented by Singh (1997) with 65% shading to normal light. Similar result was also reported by Rahman (2006).

References

Ali, M.A. 1999. Performance of Red amaranth and Lady's finger growth at different orientatioÿÿ and distances under Guava and Drumstick trees. MS. Thesis. BSMRAU, Gazipur, Bangladesh.

BBS. 2007. Statistical Pocket Book of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Govt. of Peoples' Republic of Bangladesh.

Fawusi, A.O.A. 1985. Influence of spatial arrangements on the growth, fruit and grain yields and yield components of intercropped maize and okra. Field crops Res., 11(4): 345-352.

Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for agricultural research. (2nd eds) John Wiley and Sons. Inc., New York. p 680.

Islam, M.S. 1996. Effect of shading on gas exchange characteristics and productivity of mungbean and blackgram. M.S. Thesis, Dept. of Agron. IPSA, Gazipur, Bangladesh.

Miah, M.M.M 2001. Performance of five winter vegetables under different light conditions for Agroforestry systems. MS Thesis, BSMRAU, Bangladesh.

Muoneke, C.O. and A. C. C. Udeogalanya. 1991. Respons of okra to plant density and pattern of plant arrangement in Nigeria. Indian J. Agril. Sci., 61(10): 726-730.

Murshed, A.N.M.M. 1996. Influence of management conditions on growth, flowering and pod set, seed development and yield of chickpea. Unpublished MS Thesis, IPSA, Bangladesh.

Rahman, M. Z. 2006. Performance of cane and eggplant in multistoried agroforestry system. M. S. thesis. Dept. of agroforestry HSTU, Dinajpur.

Singh, S. 1997 . Growth and yield response of different crop species to low light and high temperature humidity stress. Indian J. Plant Physiol. 2(2): 151 -155. (Cited from Hort. Abs. 1998. Vol. 68 No. 9).

Sivan, P. 1984. Effect of some intercrops on taro. Proc. 6th Symp. Intl. Soc. Trop. Root. 103-107.

Schoch, P.G. 1972. Effects of shading on structural characteristics of the leaf and yield fruit in Capsicum anmum L.J. Amer. Soc. Hort. Sci. 97 (4): 461-464.

Wadud, M. A, 1999. Performance of four summer vegetables under reduced- light conditions for Agroforestry systems. M. S. Thesis, BSMRAU, Gazipur, Bangladesh.

Wollf, X.Y. and Coltman, R.R. 1990. Productivity of eight leafy vegetable crops grown under shade in Hawaii. Journal of American Society for Horticultural Science 115:1, 182-188 : 18.